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October 5, 1993

DOCKET FILE COPY ORIGINAL

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20006
STOP CODE: 1170

Re: Ex Parte Communication in PR Docket No. 93-61

Dear Mr. Caton:

Pursuant to Section 1.1206(a)(2) of the Commission's Rules, notice is hereby given of an ex parte communication regarding the above-referenced proceeding. An original and one copy of this letter and its attachments are being filed with the Secretary's Office.

This afternoon, Pinpoint Communications, Inc. ("Pinpoint") presented a demonstration of its automatic vehicle monitoring ("AVM") system in the Commission's Meeting Room. Making the presentation were Charles L. Taylor, President; Louis M. Jandrell, Vice President of Design and Development; W. Wayne Stargardt, Vice President of Marketing; and James A. Pautler, Vice President of Engineering of Pinpoint. Accompanying these representatives of Pinpoint were Mimi W. Dawson, David E. Hilliard, Edward A. Yorkgitis, Jr., and Barbara G. Burchett of Wiley, Rein & Fielding, Pinpoint's counsel.

Attending the demonstration were the following advisors to the Commissioners and members of the Commission staff:

Jonathan Cohen, Legal Advisor to
Chairman James H. Quello

John C. Hollar, Legal Advisor to
Commissioner Ervin S. Duggan

James R. Coltharp, Special Advisor to
Commissioner Andrew C. Barrett

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Ralph A. Haller, Chief, Private Radio Bureau (PRB)
Kent Nakamura, Legal Counsel to PRB Chief Haller
Ronald F. Netro, Engineering Assistant, PRB
Rosalind K. Allen, Chief, Land Mobile and Microwave Division, PRB
Steve Sharkey, PRB
Robert H. McNamara, PRB
Herbert W. Zeiler, PRB
Martin D. Liebman, PRB

Thomas P. Stanley, Chief Engineer, Office of Engineering and Technology (OET)
Stevenson S. Kaminer, Attorney for OET

Michael J. Marcus, Assistant Bureau Chief for Technology, Field Operations Bureau

Messrs. Taylor, Jandrell, Stargardt and Pautler provided a demonstration to the attendees of Pinpoint's AVM system, which has been constructed on an experimental basis in Washington, D.C., and answered questions related to the system's operation. The Pinpoint representatives also reiterated and expanded on Pinpoint's positions expressed in its Comments and Reply Comments Pinpoint filed in this proceeding.

Attached hereto is a copy of the documents made available to the attendees of the demonstration.

If there are any questions regarding this matter, please contact the undersigned.

Respectfully submitted,

Edward A. Yorkgitis, Jr.
Attorney for Pinpoint Communications, Inc.

EAY/ean
Enclosure
cc: Ralph A. Haller
Thomas P. Stanley
Jonathan Cohen
John C. Hollar
James R. Coltharp
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What Is IVHS?

IVHS

Intelligent Vehicle-Highway Systems. Complementary technologies encompassing information processing, communications, control, and electronics combined to improve transportation in the United States.

IVHS America

IVHS America is a non-profit educational and scientific association that plans, promotes and coordinates the development of intelligent vehicle-highway systems in the United States. The association is a federal advisory committee to the U.S. Department of Transportation.

Membership

Pinpoint is a private member company of IVHS America, along with other transportation, communications and electronics industry members. Other members include local, state and federal government agencies, academic institutions and related associations.

Action

The 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) was enacted to "develop a national intermodal transportation system that is economically sound, provides the foundation for the Nation to compete in the global economy, and will move people and goods in an energy-efficient manner." IVHS is the only way to achieve this goal.

IVHS Goals

- Improved Safety
- Reduced Congestion
- Increased and Higher Quality Mobility
- Reduced Environmental Impact
- Improved Energy Efficiency
- A viable U.S. IVHS Industry

IVHS Areas

- Advanced Traffic Management Systems (ATMS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Vehicle Control Systems (AVCS)
- Commercial Vehicle Operations (CVO)
- Advanced Public Transportation Systems (APTS)

Making it Happen

Building more roads and expanding existing roads is only part of the answer. We must use the roads we have more effectively. The flight to suburbia has reached its maximum commutable tolerance. The environment and air quality continue to suffer from clogged roadways. Public transportation, which is a viable alternative, remains largely unattractive to drivers and often has a limited metropolitan reach. Commercial vehicles that carry this country's goods are being slowed down by traffic congestion, weigh stations, tolls, excessive paperwork and are unable to communicate with a home base most of the time.

Technology Designed With IVHS in Mind

Pinpoint has the only functional communications solution at the price point needed to make IVHS a widespread reality. Pinpoint's founders designed the ARRAY™ network with IVHS in mind.

Advanced Traffic Management Systems (ATMS)

ATMS is the building block of all IVHS functional areas. It will collect, use and disseminate real-time data on congested arterial streets and expressways and will alert transit operators of alternative routes. Dynamic traffic control systems will respond to changing traffic conditions across different jurisdictions and types of roads by routing drivers around delays where possible. Rapid detection of response to traffic incidents will be especially effective in reducing congestion on expressways.

Existing Technology in Use Today

Loop Detectors
Closed Circuit TV
Signpost
Global Positioning System (GPS)
Narrowband Two-Way Radio

Drawbacks to Existing Technology

Existing Approaches Impractical

- Cost and infrastructure investment impractical
- Existing two-way communications options too costly and performance and capacity are limited
- Installation effort mammoth

Pinpoint's Solution

- Integrated vehicle location and communications function over a single network
- Real-time traffic monitoring
- Two-way, high-speed data communications
- Integrated Automatic Vehicle Location
- Responsive Demand Management
- High subscriber capacity

Advanced Traveler Information Systems (ATIS)

ATIS provides information that assists travelers in reaching a desired destination via private vehicle, public transportation or a combination of the two. On-board navigation systems are an ATIS building block. Information will include locations of incidents, weather and road conditions, optimal routes, recommended speeds and lane restrictions.

Existing Technology in Use Today

Communication	One-way paging Cellular Specialized Mobile Radio (SMR)
Location/Navigation	Global Positioning System (GPS) Dead Reckoning On-board Navigational Computer

Drawbacks to Existing Technology

Existing Approaches Impractical

- Transmission is not fast enough, nor is there adequate bandwidth
- Far too expensive — the driver won't pay
- Locating function unreliable for urban IVHS applications
- Cost of air time and vehicle equipment too high
- There is no integrated location function
- The architecture is inefficient for IVHS requirements
- There is simply not enough system capacity to handle the messaging requirements of ATIS.

Pinpoint's Solution

- Integrated vehicle location and communications function over a single network
- Integrated AVL function that penetrates urban areas
- Navigation without GPS or signpost
- Two-way, digital data communications that is spectrum efficient
- High-volume message handling capability
- High-speed data transmission
- Fully automated emergency alert

Commercial Vehicle Operations (CVO)

Commercial Vehicle Operations are intended to improve the safety and efficiency of commercial vehicle and fleet operations. CVO, as part of IVHS, will increase driver safety, expedite deliveries, improve operation efficiency, improve incident response and decrease operational costs.

Existing Technology in Use Today

Communication

One-way Paging
Cellular
Specialized Mobile Radio (SMR)
Low Earth Orbiting Satellites (LEO)

Location/Navigation

Global Positioning System (GPS)
Dead Reckoning
On-board Navigational Computer

Drawbacks to Existing Technology

Existing Approaches Impractical

- Use of LEO and other satellite communications is very expensive and is unreliable in urban areas
- Cellular, SMR are costly and inefficient for widespread CVO
- Satellite-based/GPS services are unreliable in urban areas
- In-vehicle equipment and other network components are expensive with satellite-based service

Pinpoint's Solution

- Integrated vehicle location and communications function over a single network
- Efficient use of spectrum
- High capacity, low cost
- Accurate vehicle location in severe urban multipath environments
- Low-cost, in-vehicle equipment

Advanced Public Transportation Systems (APTS)

APTS applies advanced electronic technologies to the deployment and operation of high-occupancy, shared-ride vehicles such as conventional buses or rail service. Technologies from ATMS and ATIS in the area of communications, navigation and advanced information systems are applied to APTS. Developments in ATMS and ATIS will improve mass transportation services and will be used to inform travelers in real time of alternative schedules, costs or the most advantageous routing, for example.

EXISTING TECHNOLOGY IN USE TODAY

Communication

One-way Paging
Cellular
Specialized Mobile Radio (SMR)

Location/Navigation

Global Positioning System (GPS)
Dead Reckoning
On-board Navigational Computer

DRAWBACKS TO EXISTING TECHNOLOGY

Existing Approaches Impractical

- Communications and location functions via satellite are unreliable in urban areas
- High cost
- Communications and location infrastructure is costly and arduous to implement
- Spectrum and capacity limitations

PINPOINT'S SOLUTION

- Integrated vehicle location and communications function over single network
- Accurate location in urban areas
- Two-way, real-time, cost-effective data communications and location monitoring
- Driver assistance and security functions
- Fleet monitoring information
  - Integration of computer dispatch, customer information and security functions

Pinpoint Communications, Inc.

Pinpoint Communications of Dallas, Texas, has developed the ARRAY System, a highly efficient robust technology for wide-area automatic vehicle monitoring (AVM) in the 902-928 MHz band.

While Pinpoint can operate in an 8 MHz allocation, use of 12 to 24 MHz would yield tremendous gains in throughput and the rate at which vehicles can be located.

> Throughput increases geometrically with bandwidth.
>
> A doubling of the bandwidth from 8 MHz to 16 MHz leads to up to an 8 times increase in the number of vehiocle locations in a given space of time.
>
> These gains in capacity will be needed to support Intelligent Vehicle Highway Systems (IVHS).

Greater bandwidth can be made available to wide-area systems through sharing of the spectrum with local-area AVM systems such as those designed for toll collection and rail car location.

> Such sharing requires relatively robust wide-area technology and is feasible based on power/height management (e.g. lower power/lower height for local-area systems and higher power/higher height for wide-area systems).
>
> In cooperation with AMTECH Corporation, Pinpoint has tested sharing with local-area technology and proved that both types of AVM systems can coexist consistent with a high quality service.

Wide-area systems can share amongst themselves through time division multiple access (TDMA).

> TDMA allows for a variety of wide-area technologies to compete.
>
> Competition amongst wide-area AVM systems will foster the development of more robust and more efficient technologies.

The ARRAY System can serve many needs requiring vehicle location with related data communications: IVHS (traffic management and optimum routing); computer assisted fleet dispatching for public safety, transportation, and commercial delivery; motorist assistance; and stolen vehicle recovery.

> The ARRAY System combines data with each vehicle location transmission for greater efficiency and cost-effective equipment.
>
> Unlike other systems that depend on separate forward links and separate mobile data transmissions -- both of which employ slower signalling -- the ARRAY System uses the same type of short pulse, high speed signalling for base-to-mobile and for mobile-to base communications.

Sharing to Make Optimum Use of the 902 - 928 MHz Resource

Open a window to allow wide-area applicants to file applications.

All qualified wide-area applicants in a market become part of a sharing group and must agree upon a time division multiple access plan.

Facilitate sharing among wide-area and local-area systems by setting relatively low height and low power limits for local-area systems with higher power and height limits for the wide-area systems.

> If necessary, establish "low noise" sub-bands in which local-area systems would be subject to even lower power requirements so as to facilitate the use of less robust wide-area technologies.

Do not change the Part 15 requirements, but encourage all AVM operators to deploy systems sufficiently robust to overcome the normal increase in noise created by the operation of FCC approved Part 15 devices.

Do not simply convert earlier existing wide-area licenses to a position of exclusivity.

> Conversion would reward spectrum speculation and warehousing by those who applied under a shared regime, were granted extended implementation schedules and built few or no systems.
>
> Exclusivity on an interim basis as proposed in the NPRM would amount to *de facto* permanent exclusivity. It would cover far more than the top 50 markets and would permanently foreclose competition since incumbents would have no incentive to accommodate shared use.

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TECHNOLOGY

REDEFINING AVL AND DATA

The union of Automatic Vehicle Location and mobile data communications could be more than a marriage of convenience.

By Louis Jandrell
Pinpoint Communications Inc.

The future of automatic vehicle location (AVL) lies in broadening its definition for greater market acceptance and applicability. By itself, AVL is of limited utility. To solve real-world applications, AVL needs to be married to two-way mobile data communications. Providing AVL and mobile data communications through separate systems, however, is inefficient and wastes radio spectrum. Future AVL systems also need to minimize the limitations of multipath and use more spectrum-efficient protocols. New technologies that combine these functions and features into an integrated, cost-effective service are creating a more promising future for AVL.

AVL'S TRADITIONAL ROLE

Location technology has a long history, with the first successful system, Loran-C, built by the U.S. Coast Guard for coastal and inland water navigation. Since that time, new terrestrial and satellite systems have been developed, ranging from dead-reckoning to commercial and governmental Global Positioning Satellite (GPS).

All vehicle location technology to date has served primarily as a navigational aid, providing the vehicle operator with the vehicle's position relative to a coordinate system. While this is important to navigation, it has little value when trying to improve the efficiency or effectiveness of mobile operations with computer-aided automation. Business or consumer applications usually do not need a system to tell the driver of his/her own location. The concept of automated vehicle management (versus monitoring) implies the need for two-way data communication in addition to vehicle location.

AVL is usually only a part of a broader system addressing real-world applications like route guidance, mobile resource management, emergency aid or stolen vehicle recovery. For automated or computer-aided vehicle management, the vehicle's position needs to be communicated to someone other than the driver—the dispatcher or a support center—in order to be useful in a commercial or public safety application.

Early solutions that combine existing communications systems with navigational systems for locating, managing, and supporting a roaming vehicle or fleet have resulted in high equipment cost because they forced together disparate pieces of equipment that had been designed for separate functions. Further, the cost of operation is com-

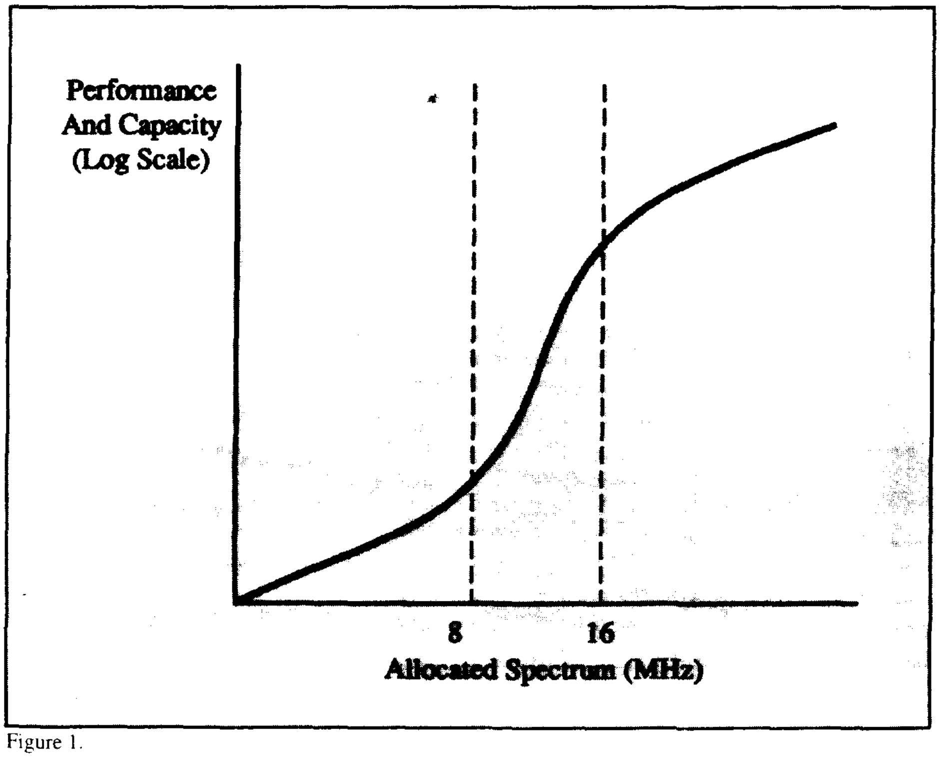

Figure 1.

pounded by the need to transmit a vehicle's coordinates to the dispatcher or support center whenever required. As a result, only very few, highly-valued or sensitive applications (i.e. nuclear waste transportation) have been able to afford such technology.

Recently, systems providing truly automatic remote vehicle location have been introduced for niche applications. These terrestrial radio location networks provide primarily stolen vehicle recovery and have introduced limited emergency breakdown service and fleet management functions. They provide a glimpse of the potential benefits of a modern, redefined AVL system.

AVL needs a new technological standard that can meet the needs of a broad range of real applications requiring automated vehicle management. This technology must provide solutions to large numbers of users at low equipment and operating costs.

INTELLIGENT MOBILE DATA NETWORKS

In the future, modern AVL systems will promote or enable the implementation of automatic vehicle management. Most real automated vehicle management applications require both remote vehicle location and two-way mobile data capabilities. For example:

- **Fleet Management**. The fleet manager needs to know the location of each vehicle to select the optimal one to dispatch, to send information (i.e., dispatch instructions and information, directions) and to receive information (i.e., vehicle status, cargo status, transaction information) to and from each vehicle.
- **Emergency Roadside Services**. The provider of roadside services needs to know the nature of the emergency (i.e., out of gas, flat tire, breakdown, dangerous situation) as well as the location of each vehicle having trouble; the service provider also needs to tell the subscriber who is responding and when they will arrive.
- **Vehicle Security Monitoring**. The security monitoring firm wants to know both the location of the vehicle and the nature of the alarm (i.e., glass breakage, ignition without key, fire, unauthorized movement). In addition, the monitoring firm needs to be able to trigger actuators in the vehicle (i.e., turn horn on and off, turn ignition or fuel system off).
- **Smart Car Systems**. These systems track the location of a large number of vehicles to spot traffic congestion as it develops. Smart car systems send information to the vehicles to route them around traffic problems, and these systems get information from the vehicles on their intended destination.

This redefined AVL system must do more than combine remote vehicle location and mobile data communications. The system must be easy to use for end users and easy to implement for application developers. The system should share the radio spectrum and the common network infrastructure among a large number of subscribers to minimize the cost to any one subscriber. Initial requirements would be a harmoniously integrated system incorporating both two-way data communications and AVL, with an added intelligence and feature richness that makes everyday applications possible and affordable.

Real applications need a system that can provide adequate performance and flexibility. For example, response latency can be a problem, since a cab could not be dispatched effectively if the last available position fix is too old or takes too long to get. Having a flexible packet size makes the system more cost-effective because the user doesn't have to pay for too many partially empty packets. Position fix accuracy also is critical because it is not enough to locate an officer in trouble or a disabled vehicle downtown within a one-block radius.

The modern, redefined AVL system of the future must deliver all of these capabilities to serve the majority of automated vehicle management applications. The technology advances that enable such a service have recently been developed, and networks that combine AVL and mobile data communications are beginning to emerge. These networks are called Intelligent Mobile

Making Room

One aspect of AVL systems that will require close cooperation between mobile data, AVL and IMDN operators is the use of the shared 902-928 MHz band. This band is currently the only spectrum with potentially sufficient bandwidth to implement the high-speed, high-capacity networks that will be needed to fulfill the high volume demands of applications such as the Intelligent Vehicle Highway System (IVHS), vehicle security, and other fleet management applications that will grow at explosive rates when the service becomes available at the price-points offered by these new capabilities.

The 902-928 MHz automatic vehicle monitoring (AVM) or AVL band is currently operated under interim rules dating back to 1974 when the FCC established the original rules to encourage the development of automatic vehicle location technologies and applications. For many reasons, these rules are now overdue for change. Most important is the need for more permanent rules and technical guidelines for the implementation of systems that reflect the advancement of current and future communications technologies and applications.

The interim rules were established within a shared band that has been a "catch-all" band for various technologies, including industrial, medical and scientific application, radio local area networks, spread spectrum communications, part 15 cordless phones, radio-amateur TV and repeater control and some military radio location operations. By these interim AVL rules, the band is divided into four sub-bands for different AVL applications, with each sub-band having insufficient bandwidth to reach the critical threshold for efficient, high-speed, high-capacity AVM/AVL applications (with combined radio location and two-way data communications).

Since this is the only band currently available for AVM users, it is important that techniques be found for this band sharing that allow each of the users access to at least the necessary minimum threshold band when needed. This way, availability for all users is not compromised by the simpler methods of frequency division allocations that are potentially disastrous to overall band throughput.

—LJ

Data Networks (IMDNs). The benefits of these spectrum-efficient networks are inherent low-cost, large subscriber capacities, high speed data communications and accurate vehicle location.

SPECTRUM—A PRIORITY

Because spectrum is a scarce and valuable public resource, it needs to be allocated and used in a most efficient manner. In this context, AVL alone presents a serious allocation dilemma. By its very nature, high speed terrestrial radio location technology requires a wide bandwidth for accurate position determination. Since AVL alone, without data communications, does not completely solve the needs of most potential users, it is difficult to justify dedicating such large portions of this public resource to a narrowly limited function.

Use of this spectrum would be better justified if it performed both high volume data communications along with fast, remote radio location. A well-designed Intelligent Mobile Data Network would make efficient use of a wide spectrum allocation because it performs data communications and AVL simultaneously in the same band. This concept requires critical evaluation.

Because of the urban radio environment, IMDNs need a significant amount of spectrum to be effective. In particular, the typical AVL communication environment has been very challenging. The severity of multipath fading and scattering distortion have always been the bane of mobile communications engineers trying to design reliable communications links. For an IMDN, the interaction of inherent characteristics of the metropolitan mobile communications environment with the design of the communications equipment can dramatically improve or degrade the rate at which position fixes can be made and the volume of data that can be communicated. Some of the more important factors affecting performance are: (a) multipath delay spread, (b) interference and noise, (c) available bandwidth, (d) signal fading, (e) data encoding schemes, (f) data detection schemes and (g) radio and system protocols.

The effect of these factors is that the performance and capacity of an IMDN does not increase proportionately with the amount of spectrum allocated to it. As shown in Figure 1, the capabilities of an IMDN-type network are relatively limited when the allocated spectrum is small. There is a bandwidth threshold above which the performance and capacity of an IMDN increase dramatically. This threshold occurs when enough bandwidth is available to resolve certain signal scattering characteristics that occur in the typical urban environment. Above this bandwidth, it becomes possible to ameliorate the destructive delay spread effects of multipath scattering on time-of-arrival measurements, which allows the IMDN to resolve position fixes more accurately and quickly. The greater bandwidth also allows the IMDN to improve the volume and reliability of data transmissions.

As shown in Figure 1, the bandwidth threshold for IMDN technologies to become effective against multipath is in the range of about 16 to 25 MHz, depending on the complexity and cost of the signal modulation schemes and detectors used in the transceivers.

PRICE PERFORMANCE

Many factors have contributed to new understandings, improved capabilities and lower costs in the communications marketplace. These factors include growing sophistication and high volumes in manufacturing processes, combined with recent developments in microprocessor and signal processing technology; sophisticated signal processing techniques developed for satellite and radar signal analysis; and the developments in mass communication markets such as cellular telephone.

By combining many of these new technologies, it is possible to create a modern Intelligent Mobile Data Network with mass market appeal. Such an IMDN can produce multiple order-of-magnitude increases in performance and reduction in cost over prior approaches that combine separate navigation and communications systems. By operating in the currently available AVL spectrum, a well-designed IMDN often overcomes the distortion that multipath scattering causes in remote radio location. And the reliability of IMDN packet data transmission increases by combining the message signal energy in each of the multipath echoes.

A few companies can now demonstrate IMDN technologies that provide: 1) fast, remote vehicle location up to 3,000 position fixes per second in a local cluster or 30,000 position fixes per second across a large metropolitan system; 2) high-speed, two-way packet data communications up to 35,000 bytes per second in a local cluster; and 3) integrated, low-cost transponder modems that cost less than $300 retail in early production. The recent appearance of such networks makes it possible for a system to inexpensively support the communications needs of real applications for millions of subscribers in each metropolitan area.

IMDN ARCHITECTURES

An IMDN architectural approach exists that builds upon the premise of combined AVL and mobile data communications and effectively reduces the cost of mobile equipment and network infrastructure to a level of mass-market acceptance. This approach also simultaneously allows the network to achieve a very high subscriber handling capacity with all the important real application benefits previously described.

To achieve such levels of performance, this architecture must inherently allow for efficient management of available spectrum. It is capable of rapidly scheduling available spectrum in a locality when needed. And this architecture can reallocate or release spectrum when not needed—in time and space—to other different architectures that use compatible allocation approaches.

A particular treatment of this architecture uses a modulation technology that allows accurate radio location directly from the data communication signal so no additional airtime is needed for the positioning function. The overall system design of this network is very robust, allowing it to tolerate the interference levels that typically occur in shared bands. This network does not cause undue interference to other similar, well-designed systems.

There are many possible communications systems architectures that would be suitable for implementing automated vehicle management. Each architecture would likely use its own set of protocols for telecommunications, radio operation and terminal operation. And since many applications have similar needs, it is likely that disparate systems would have many "intelligent" features in common. The industry could then only benefit if providers of such architectures would develop compatible industry standards for access to those common features. This would simplify the movement of applications from one communications offering to another.

ADDING VALUE

The concept of AVL must be redefined to bring widespread automated vehicle management to reality. AVL without mobile data communications is of limited value to the market because it cannot address many real-world mobile applications. Combining navigational AVL with a separate, conventional data communications system is too expensive to be within the reach of most potential users. AVL could be harmoniously integrated with mobile data communications in a unified system to provide the low-cost, high performance capabilities needed to serve applications in multiple markets. The emerging technology of Intelligent Mobile Data Networks has the architecture to provide these capabilities.

Moreover, as the airwaves continue to become congested and spectrum becomes more precious, AVL will have difficulty operating as a separate, standalone service. The future of this technology lies in its ability to adapt to the changing needs of the communications marketplace as users and technology developers demand efficiency and cost-effectiveness through integrated solutions.

About the Author

Louis Jandrell is vice president of Design and Development with Pinpoint Communications Inc., located in Richardson, Texas. He is also a co-founder of the company.

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Corporate Profile

Forcing change in the vehicle location and mobile data communications industry, Pinpoint™ Communications has invested more than three years of intensive research and development to create the first intelligent mobile data network. An intelligent mobile data network integrates automatic vehicle location with mobile data communications and offer revolutionary price performance over existing mobile technologies. Intelligent mobile data networks will dramatically change the way individuals communicate and manage business in a mobile environment.

A pioneer in the mobile communications industry, Pinpoint recognizes the need for low-cost mobile data communications is basic and broad and is sparked by widespread commercial and consumer demand. The company's team of visionaries set out to fuel the changes required to meet the basic market needs and demands. Pinpoint operates the intelligent mobile data network and partners with applications developers that offer information and geolocation services to commercial users and general consumers.

Pinpoint is based in Dallas and is a privately-held corporation heavily endowed by private technology investors that share in the vision of a nationwide intelligent mobile data network and the benefits it will provide in increased mobile management efficiency and elevated public safety.

Pinpoint's ARRAY™ network overcomes previous price performance barriers and sets new standards for a myriad of mobile applications. It achieves this by integrating the functions of mobile vehicle location and message delivery into a single, low-cost mobile communications hardware solution — the TransModem™.

The company's mission is to engineer the network and act as its prime contractor to enable a wide range of applications that are not practical with current technology. Pinpoint is a service provider.

Pinpoint envisions applications that will enhance and further expand capabilities in the area of fleet management, vehicle security, emergency communications, mobile two-way messaging, mobile point-of-sale terminals and "smart car" systems that include traffic, direction and routing information all at the driver's fingertips.

Pinpoint's goal is to provide a universal, accessible, low-cost infrastructure for these applications and encourage its development and expansion through existing vertical market specialists. Pinpoint's ARRAY technology will complete the spectrum of value-added services that distributors can provide.

Pinpoint's ARRAY network will alter the future vision of mobile communication and location technology by offering greater functionality, reliability, quality services and low-cost applications to millions of users. Pinpoint intends to drive information services forward and ultimately link the world through an intelligent mobile data network.

Pinpoint

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Executive Biographies

Charles L. Taylor

- ▲ Chairman of the Board
- ▲ President
- ▲ Co-Founder
- ▲ Executive Committee of the Board of Directors

Mr. Taylor is co-founder and president of Pinpoint™ Communications, Inc. With a diverse, technology-rich background, from president to COO and respected consultant to author, Mr. Taylor is considered a communications industry expert, with special expertise in radio communications, telecommunications and electronics.

Prior to Pinpoint, Mr. Taylor presided over The Matrix Company – a company active in RF communications, telecommunications, microprocessor control and electronic product development serving Regional Bell Operating Companies and electric utility companies. Mr. Taylor was responsible for all phases of business development and financial planning.

As vice president and chief operating officer of Third Wave Technologies Corp., Mr. Taylor was responsible for design and development of radio emergency communications and positioning systems. The company designed the Vital Information Network – a medical computer database that interfaces with 911 centers.

During an independent consulting venture, he formed Charles Taylor & Associates and specialized in counter-surveillance communication technologies. During this period he authored two books on electronic training and was called upon by various technology publications for his opinions and views of the industry.

Louis M. Jandrell

- ▲ Vice President of Design and Development
- ▲ Co-Founder
- ▲ Executive Committee of the Board of Directors

Mr. Jandrell discovered Pinpoint's revolutionary technology and is co-founder and vice president of design and development. He is world renowned for his technological innovations and has far-ranging experience and expertise in technical design, product development and development program management.

Before Pinpoint, Mr. Jandrell founded The Matrix Company and provided consulting services in areas of electronic design, product definition and specification, and manufacturing processes and technologies.

Mr. Jandrell's professional accomplishments are recorded across diverse industries, ranging from FM–SCA radio data systems to global satellite-based positioning systems and satellite TV receivers to LAN computing modules and paging systems. He also has drafted, processed and defended patent applications and developed product programs for energy management OEMs.

Additionally, Mr. Jandrell has been product development manager for Astec Electronics and Sunflex Company. At Astec he managed the development and market introduction of computer peripheral products, and at Sunflex he invented, designed, manufactured and marketed new products.

W. Wayne Stargardt

▲ Vice President of Marketing

As vice president over marketing, Mr. Stargardt brings to Pinpoint varied experience in marketing, sales, research and development, engineering and product development.

Prior to Pinpoint, he was vice president of sales and marketing for Mizar, Inc., a manufacturer of embedded computer systems.

Previously, Mr. Stargardt was vice president of research and development for Harris Adacom Corporation, formerly a subsidiary of Harris Corporation, where he coordinated the efforts of 75 engineers in Dallas and Israel. He managed hardware and software product development for market-driven new products. At Harris he also held senior-level marketing positions in which he was responsible for product management, product planning, market planning and customer support.

As a consultant for Booz, Allen & Hamilton, Inc., Mr. Stargardt also managed business and marketing strategy assignments for clients in many industries, including minicomputers, small business computer systems, factory automation and automated banking machines.

JAMES A. PAUTLER

▲ Vice President of Engineering

As vice president of engineering, Mr. Pautler oversees the development, engineering and manufacturing of the hardware systems for Pinpoint's intelligent mobile data network, ARRAY™. His primary responsibilities include designing the hardware for radio frequency (RF) analog and digital communications systems. He also is the intermediary between Pinpoint and its contractors, licensed manufacturers and suppliers.

Mr. Pautler has more than 20 years engineering and management experience within the telecommunications industry. Prior to joining Pinpoint, Mr. Pautler was with McDonnell Douglas Corp. where he spent 14 years in increasingly responsible managerial and technical positions. He was chief systems engineer for the Defense Electronics Divisions and participated in an executive rotation program as deputy of manufacturing for the fighter division of McDonnell Douglas. Most recently he was division deputy for McDonnell Douglas' Total Quality Management activities. Before McDonnell Douglas, he spent six years as a research engineer with Motorola Inc.